Special Issue Published in International Journal of Trend in Research and Development (IJTRD), ISSN: 2394-9333, www.ijtrd.com

Blue Brain Technology

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Abstract- Blue Brain is basically a virtual brain and it is the creation of synthetic brain by Reverse Engineering. 'Blue Brain is the name of world's first virtual brain. That means a machine can function as a human brain. The Blue Brain project began on July 2005 as a collaboration between professor Hendry Markram from Brain Mind Institute and IBM (International business machines). Blue Brain project was started in order to preserve this intelligence by uploading it into a digital machine. Scientists are in research with this technology by using artificial brain that can think, response, take decision and keep anything in memory. It's main Aim is to upload human brain in machine, So that man can take decision without any effort. And it can be used for the future development of our society.

Keywords *- Blue Brain , Blue gene , Virtual brain, Artificial Intelligence, Reverse Engineering, Digital Computer.*

I. INTRODUCTION

Blue Brain is basically a Virtual brain. Blue Brain works under the principles of"REVERSE ENGINEERING". The Virtual Brain is the combination of Artificial Intelligence and Neuron functions[1]. Virtual Brain rewards the data of the Human through their neuron function in the Computer it is otherwise called as "BLUE BRAIN". It Aims to create a digital reconstruction of Brain.

Figure.1 Blue Brain.

The brain translates the information delivered by the impulses,which then enables the person to react.But the brain will lose its knowledge when the body is destroyed. The goal of this Blue Brain is to gain a complete understanding of the brain and enable better and faster development of brain disease treatment[1]. The blue brain research involves studying about the slices of living brain issue using microscopes and patch clamp electrodes.Those data are about different types of neurons, which is used to build biological and realistic model of Neurons.The recent scale of Blue Brain is same as the Honey Bee Brain. It is hoped that Rat Brain Technology will be achieved by the end of 2014, and it will be launched by 2023.The simulation of human brain project are carried out on a Blue Gene Super computer built by IBM,hence named as "Blue Brain".

II. NATURAL BRAIN

The brain essentially serves as the Body's Information Processing Center (BIPC). It receives signal from sensory neurons[1]. The brain's weight is 1,500 grams (3pounds) of constitutes and 2 percent of total body weight. The human ability is to feel, interpret and even seeing is controlled in computer like calculations, by the magical Nervous system[2]. To understand this system one has to know three simple functions :

- Sensory Input.
- Interpretation Input.
- Motor Output.

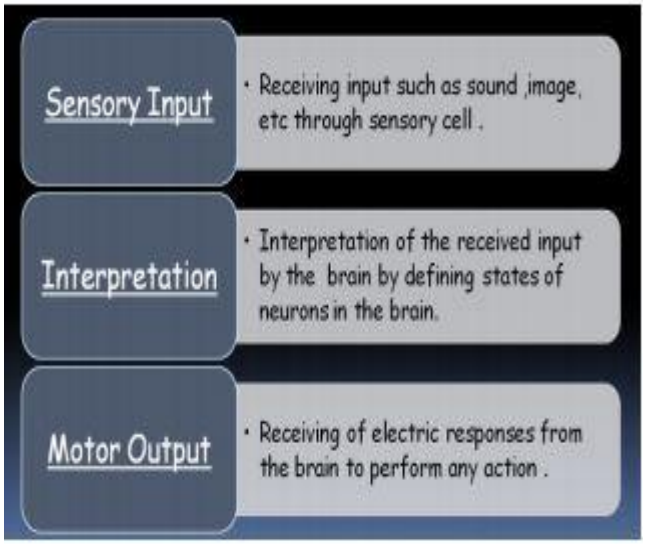

Figure.2 functions of natural brain.

A Sensory Input

The action of getting information fron your surrounding environment is called Sensory input. The touching and seeing process is called Sensory cells, and are also called as Neurons,Neurons send message straight to the Brain [2].

B Interpretation Input

The Intergration is also called as Interpretation of things that we have felt, tasted and touched.Neurons responses to the body recognizes. This process has been verified using neurons to understand the environment.

C Motor Output

Output in the sense the outcome, of what have been touched, tasted or sensed.In Motor Output the brain sends the message through Neurons to effector cells, Which makes us to work according to the society.

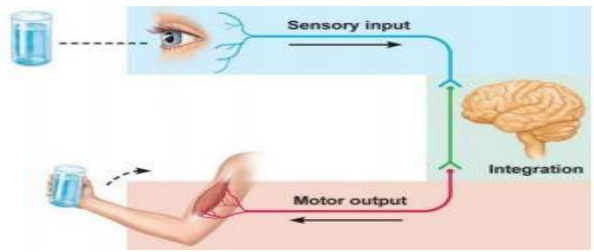

Figure.3 process of function

III. COMPARISION OF NATURAL BRAIN AND SIMULATED BRAIN

Table.1 Comparsion between natural brain and simulated brain.

NATURAL BRAIN	SIMULATED BRAIN
Input In the nervous system in our body the neurons are responsible for the message passing. The body receives the input by sensory cells. This sensory cell produces electric impulses which are received by neurons. The neurons transfer these electric impulses to the brain.	*Input* In a similar way the artificial nervous system can be created. The scientist has created artificial neurons by replacing them with the silicon chip. It has also been tested that these neurons can receive the input from the sensory cells. So, the electric impulses from the sensory cells can be received through these artificial neurons.
Interpretation The electric impulses received by the brain from neurons are interpreted in the brain. The interpretation in the brain is accomplished by means of certain states of many neurons.	*Interpretation* The interpretation of the electric impulses received by the artificial neuron can be done by means of registers. The different values in these register will represent different states of brain.
Output Based on the states of the neurons the brain sends the electric impulses representing the responses which are further received by sensory cell of our body to respond neurons in the brain at that time.	*Output* Similarly based on the states of the register the output signal can be given to the artificial neurons in the body which will be received by the sensory cell.
Memory There are certain neurons in our brain which represent certain states permanently. When required, this state is represented by our brain and we can remember the past things. To remember things we force the neurons to represent certain states of the brain permanently or for any interesting or serious matter this is happened implicitly.	*Memory* It is not impossible to store the data permanently by using the secondary memory. In the similar way the required states of the registers can be stored permanently and when required these information can be received and used.
Processing When we take decision, think about something, or make any computation, logical and arithmetic computations are done in our neural circuitry. The past experience stored and the current inputs received are used and the states of certain neurons are changed to give the output.	*Processing* In the similar way the decision making can be done by the computer by using some stored states and the received input and the performing some arithmetic and logical calculations.

IV WHAT IS BLUE BRAIN ?

Blue Brain Technology is the first one to develop "Artificial Intelligence". The Blue brain works with Virtual Brain. The vision behind the Virtual Brain will help to shed some light on the ascepts of Human Recognition[2]. It expects the result as to built the computer model of a functioning brain to cure the drug treatments or anyother brain treatment problems.

It can be implemented by using supercomputer, the fastest type but quite expensive and are assist for special tasks which require abundant amount of mathematical computations, like weather forecasting employes a supercomputer.

The back bone of Blue Brain is Artificial Intelligence, a technology which builds intelligence machines and imparts intelligent agents[3]. Knowledge, Learning, Reasoning, Planing,Communication and Perception are the main goals of its research.he first Machine that has been used by Blue Brain Technology is Blue gene supercomputers it was launched by IBM.

V NEEDS OF BLUE BRAIN

Intelligence is the inborn quality that can't be created. Intelligence is a Natural gift for every human's.The level of Intelligence varies from each person. Some have high level of intelligence and some have low level of intelligence.But the intelligence is lost along with the body after the death.The virtual brain is a solution to it[3]. The brain and intelligence will be alive even after the death.We often face difficuties in remembering things such as people's name,their birthdays and the historys...etc.

Blue Brain allows to upload their Knowledge of a person on a computer.It will help the person to remember things without any effort.Blue Brain is a only technology which helps to serve in this busy life, where everyone wants to be relaxed[3]. The Virtual brain which is also known as Blue brain is the only solution to it.

VI IMPLEMENTATION OF BLUE BRAIN

There are three ways to implement Blue Brain, they are Data Acquisition; Data simulation; Visualization of result.

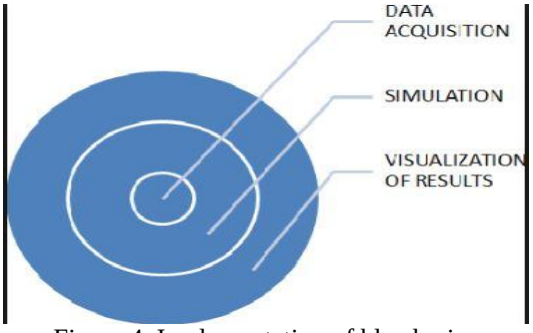

Figure.4 Implementation of blue brain.

A Data Acquisition

Data acquisition involves taking individual slices of brain and placing under microscope for observation purpose to measure the electrical activity and shape of the individual neurons. The neurons are captured accordingly by their morphology (shape), location with in the cortex their population density and electrophysiological behaviour. The method of cataloguing and studying is very familiar world wide. The observations are then translated into mathematical algorithms which describe the functions, positioning and the form of neurons. The algorithms are then used to generate biological and realistic virtual neurons ready for the simulation phase.

B Data Simulation

The data simulation itself consists of three major parts namely, they are: BBP-SDK, Simulation Speed, Simulation workflow… etc

- *BBP-SDK (Neurons)*

The primary software used by the BBP (Blue Brain Project) for neural simulation is a package named NEURONS. It is a software development kit developed in 1990's by Michael Hines at Yale University and by John Moore at Duke University. It is written by three programming language C, C++ and FORTAN. BBP-SDK is open source software and is freely available online to work upon [where the website includes the required codes and also the binary data for free]. The BBP team collaborated with Michael Hines to port the package to the large parallel Blue gene Super computer in 2005 [1].

- *Simulation Speed*

The simulation of one cortical column (more than 10,200 neurons) run at approximately 300 times slower than real time.Which means one second of simulated time takes about five minutes to complete. Currently the primary goal is the biological validity rather than the performance.

- *Simulation Workflow*

It involves synthesizing virtual cells using the algorithm that were found to describe the real neurons[3]. The algorithm and parameters are adjusted for species, diseases stage of the animal being simulated.

Data Simulation also comes under the following:

- Input.
- Interpretation.
- Output.
- Memory.
- Processing.

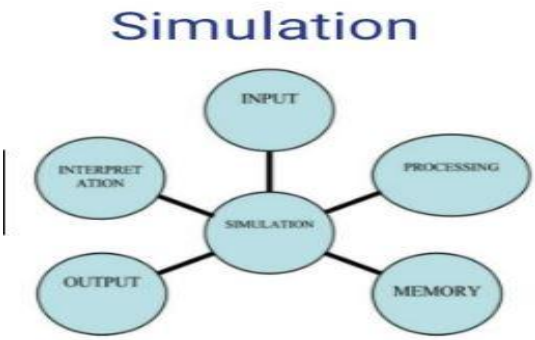

Figure:5 Data simulation.

- *Input*

In the nervous system of our body, neurons are responsible for message passing. Sensory cells convey the input to our body. Electric impluses are produced by sensory cells which are received by neurons. Further, electric impluses are transferred to the brain by neurons.

- *Interpretation*

Brain receives the electric impluses from the neurons which are interpreted by means of registers.Different states of brain can be accompished by the different values in these registers.

- *Output*

On the basis of the states of the registers, the electric impluses are sending by the brain representing the responses which are then received by the sensory cells to respond[4]. The sensory cells of whichpart of our body is going to receive that, it depends on the state of the neurons in the brain at the that time.

- *Memory*

We can store certain information (states) permanently in our brain by certain neurons.On the basis of our requirements, the brain interpets those states and thus past things can be gathered.To do so we demand the neurons, to permently show the clear vision of the brain's states.

- *Processing*

By the use of some stored states, computation will be performed by the computer. Logical and Arithmetic calculations are done in our neural circuitry. To produce the output stored past experiences and current input received are used.

C Visualization Of Result

Huge amount of data are generated by running the Blue Brain simulation[5]. Thousands of times analyses of individual neurons must be repeated. Data can be analyzed by using massively parallel computers where it is created.

A Visual exploration of the circuit is an important part of the analysis (given the geometric complexity of the column).It is invaluable for an immediate verification of single cell activity by mapping the simulation data on to the morphology. The Blue gene has been translated into a 3D visual representation of the column to design a visualization interface. A challenging task is the visualization of the neurons given the fact that a series of ten thousand neurons which is clustered in high quality, the mesh accounts for essentially 1billion triangles for which about hundreds of GB of management data is required.

VII COMPUTER HARDWARE OR SUPER COMPUTER

The primary machine used by these technology is Blue Gene super computer built by IBM [6]. This is the reason for the term "Blue Brain" IBM agreed in June 2005 to supply to supply EPFL with a Blue Gene /L it is a "Technology Demonstrator".In June 2010 the "BlueGene/L" was upgrated to **"Blue Gene /P".**

The computer is used by a name of different research groups, not exclusively by the Blue Brain Project. In 2012 the BBP was consuming about 20% of the compute time. The Brain simulations generally run all day, and one day per week. The

rest of the week is used to prepare simulations and to analyze the resulting data.

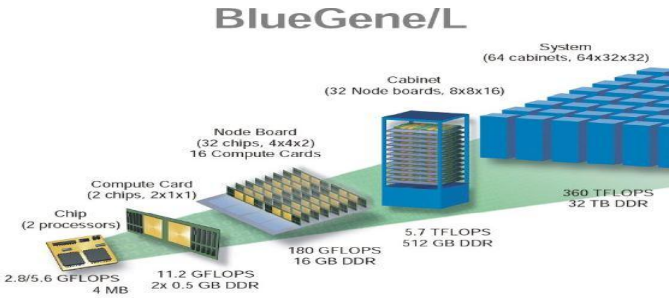

Figure.6 Blue gene/L.

VIII BLUE GENE /P TECHNICAL SPECIFICATIONS

- 4,096 quad - core nodes.
- Each core is a power PC 450, 850Mhz.
- Total: 56 teraflops, 16 terabytes of memory.
- 4 Racks, One row, wired such as 16*16*16 3D torus.
- 1PB of disk space,GPFS parallel file system.
- Operating System: Linux SuSE SLES 10.
- Silicon Graphics: A 32 – Processor Silicon graphics Inc(SGI) system with 300Gb of shared memory is used for visualization of results.

JuQUEEN

It is a Blue Gene / Q Super computer which was installed at the Julich Research centre in Germany in May 2012. It currently performs at 1.6 peta flops and was rancked as the world's 8th fastest super computer in June 2012. The JuQueen machine is also to be used by the research inistuite[6].This aims to develop a three dimensional, realistic model of Human brain.

Figure:7 JuQUEEN.

IX . APPLICATION OF BLUE BRAIN

- Gathering and testing 100 years of data.
- Cracking the Neural code.
- Understanding the Neocortical information processing.
- A Novel tool for drug discovery for brain disorders.
- A Global facility.
- A Foundation for whole Brain simulations.
- A Foundation for Molecular Modelling of brain.

X ADVANTAGES OF BLUE BRAIN

- Blue Brain is an a pproach to store and utilize human intelligence and information present in the mind even after human demise.
- It is an important move towards self decision.
- It can be used as an interface between human and animals mind.
- It is a good remedy towards human disability like a deaf can get the information Via. Direct nerve simulation.
- Even after the death of a man his Intelligence can be used.
- With Blue brain project the things can be remembered without any effort, decisions can be made without the presence of a person.

XI UPLOAD OF HUMAN BRAIN

To upload human brain Nanobots is used, it is a very small robot,which are the most promising factor for uploading. In this Emerging Technology, of uploading fields of creating machines or robots whose components are nearly close to the nanometer. Nanobots are otherwise called as nanoids, these nanoids are so small and they can travel throughtout our circulatory element[7]. To accomplish these uploading small robots known as nanobots are used. The activity and structure of our central nervous system will be monitored by them , it is known by travelling into the spine and the brain. By Scanning it carefully the structure of the brain which is the additional function of the Nanobots which provides the complete analysis of the connection.

This information helps the machine to function as the human's.By using Nanobots, the data stored in the brain can be uploaded in the computer[7].

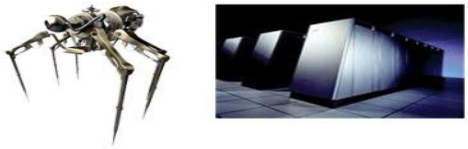

Figure:8 Nanobots with monitor.

XII LIMITATIONS

- We become dependent upon the computer.
- Others may use the technical knowledge against us.
- Computer viruses will pose an increasingly critical threat.

XIII REQUIREMENTS

- A supercomputer with high processing power processor.
- A very large storing capacity.
- A very wide interconnection network.
- A program to map electric impulses from human brain to input signal that can be received by the computer.
- Processor with a very high processing power.
- 100 kilowatts power consumption.
- Very powerful Nanobots.

Figure.8 storage racks ,that are used for experiments.

FUTURE SCOPE AND CONCLUSION

The synthesis era in neuroscience started with the launch of human brain project and is inevitable phase triggered by a critical amount of fundamental data. The data set does not need to be complete before such a phase can begin. Detailed models will probably become the final form of databases that are used to organize all knowledge of the brain and allow hypothesis testing, rapid diagnoses of brain malfunction as well as development of treatments for neurological disorders. In short, we can hope to learn a great deal about brain function and dysfunction from accurate models of the brain[3]. A model of the entire human brain at the cellular level will probably take the next decade. As with deep blue, Blue Brain will allow us to challenge the foundations of our understanding of intelligence and generate new theories of consciousness[4]. Blue Brain technology can be used in fully paralized people to communicate with the world.We have all heard about the very famous scientist Stephen William Hawking who has a motor neuron disease and is entirely paralysed. It is through a speech generating device that he communicates with the world[9]. He would be able to contribute more to the world of science if he were physically sound. Through the blue brain technology we would be able to make use of the intelligence of such great men for the future developments. Blue Brain technology can be used to know the communication between the animals and to study more about them.We have always wondered how these animals communicate with each other and how they take decisions. Using the blue brain technology we will be able to understand how this happens which will eventually help us to connect with the nature in a better way[10]. Poligraphy testing can be done with the help of this technology.The criminals and terrorists can be made to undergo this test inorder to know more about their mindset and activities which will help us to take necessary precautions to save our country from the black hands.

In conclusion, we will be able to transfer ourselves into computers at some point. Most arguments against this outcome are seemingly easy to circumvent. They are either simple minded, or simply require further time for technology to increase. The only serious threats raised are also overcome as we note the combination of biological and digital technologies.We believe that the connection with Blue Brain and Soul Catcher may exceed human intellectual capacity by around 2017, and that it is likely that we will be able to download the human brain at sometime around 2050.

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